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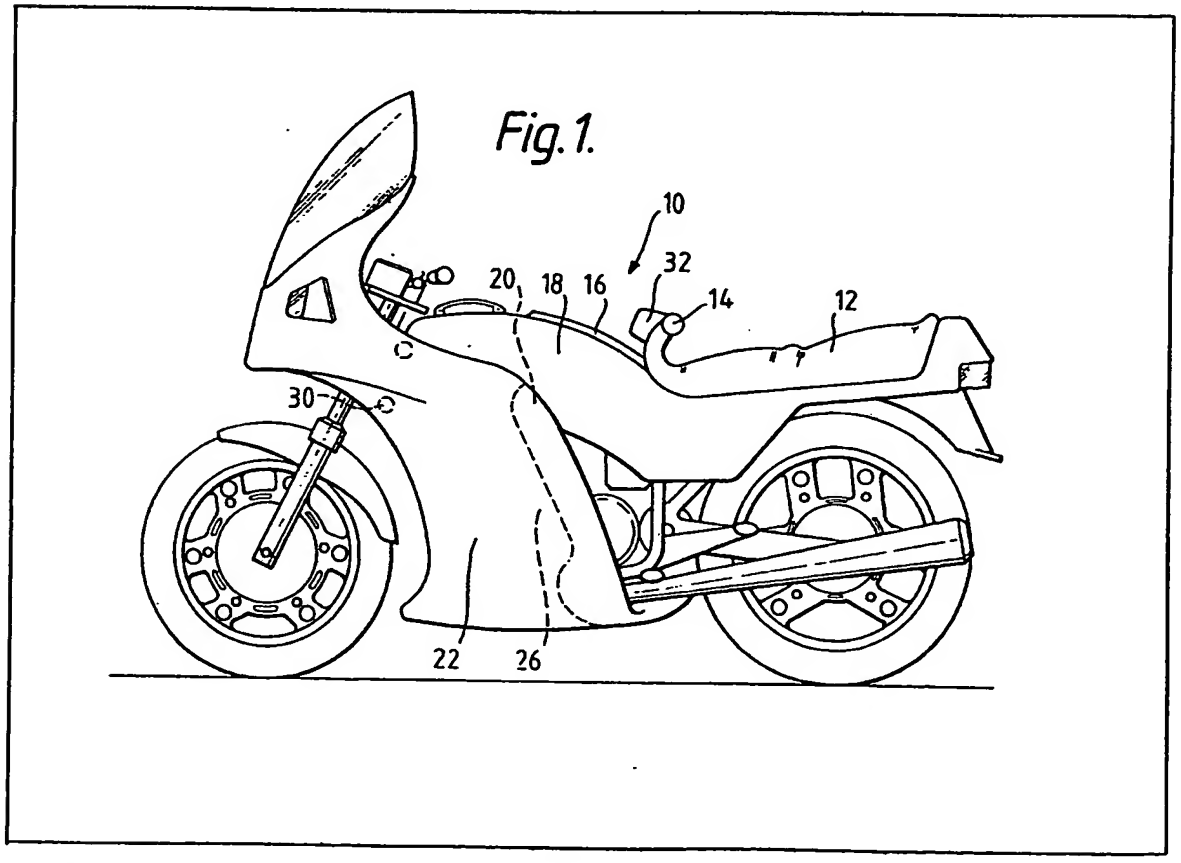
(54) Vehicle safety system

(57) In order to stop a motor-cyclist leaving the motor-cycle on head on collision a pelvic restraint 14 is provided at the front of the seat 12, and to reduce the deceleration experienced by the rider, the seat is arranged to slide forward on a guide 16 over the tank 18 and the deceleration is controlled by an energy absorber attached between the slideable seat and the motorcycle frame. To reduce the possibility of impact with the motor-cycle structure, the motion of the seat may initiate the inflation of an airbag on the pelvic restraint.

Also described is an energy absorbing system for use in a car in which the seat may slide along a guide, subject to energy absorbing means, to absorb impact forces (Fig. 5 not shown). The invention may be extended to sliding platforms for goods.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

Fig.1.

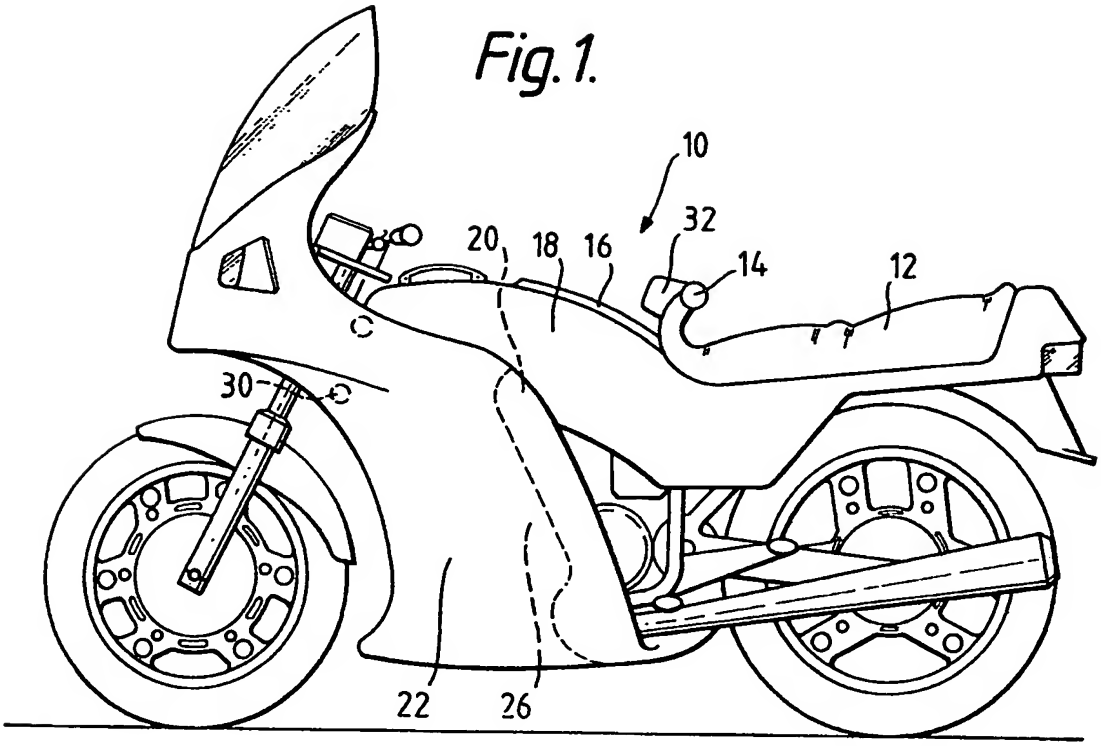


Fig.2.

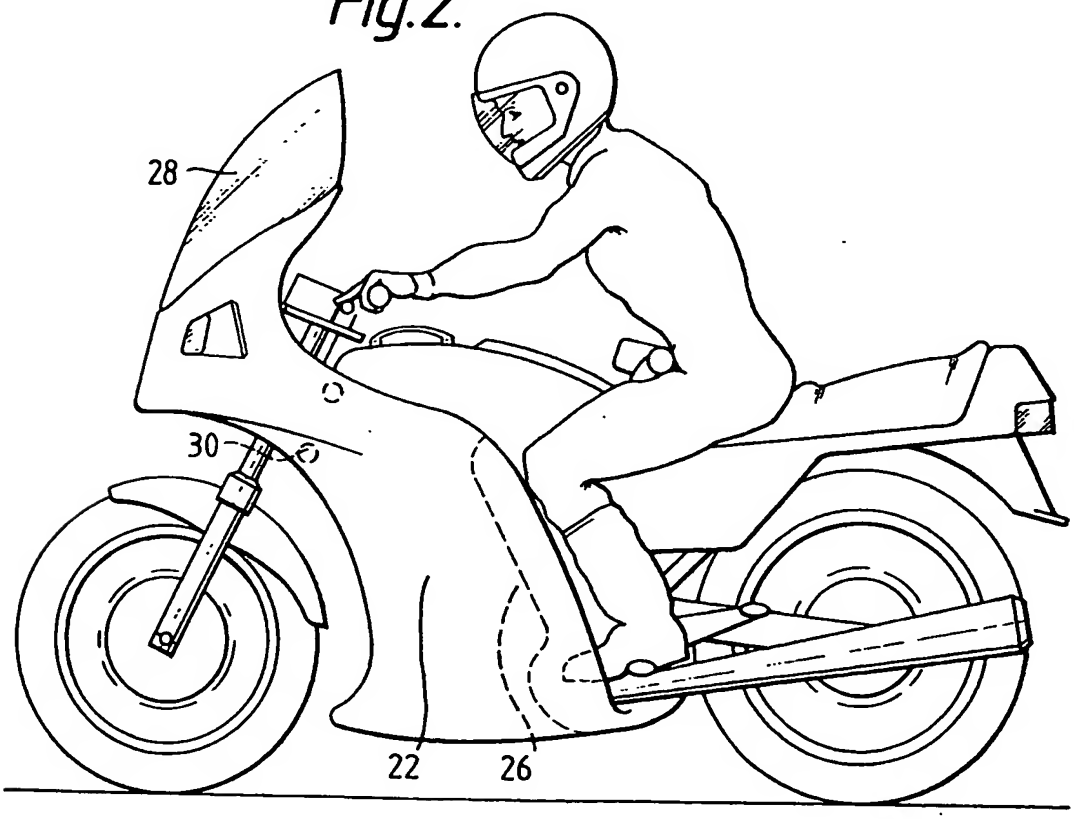


Fig.3.

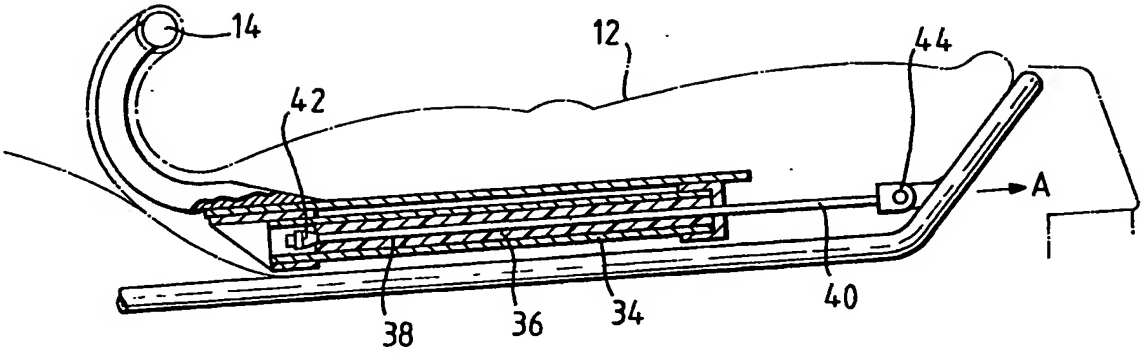


Fig.4.

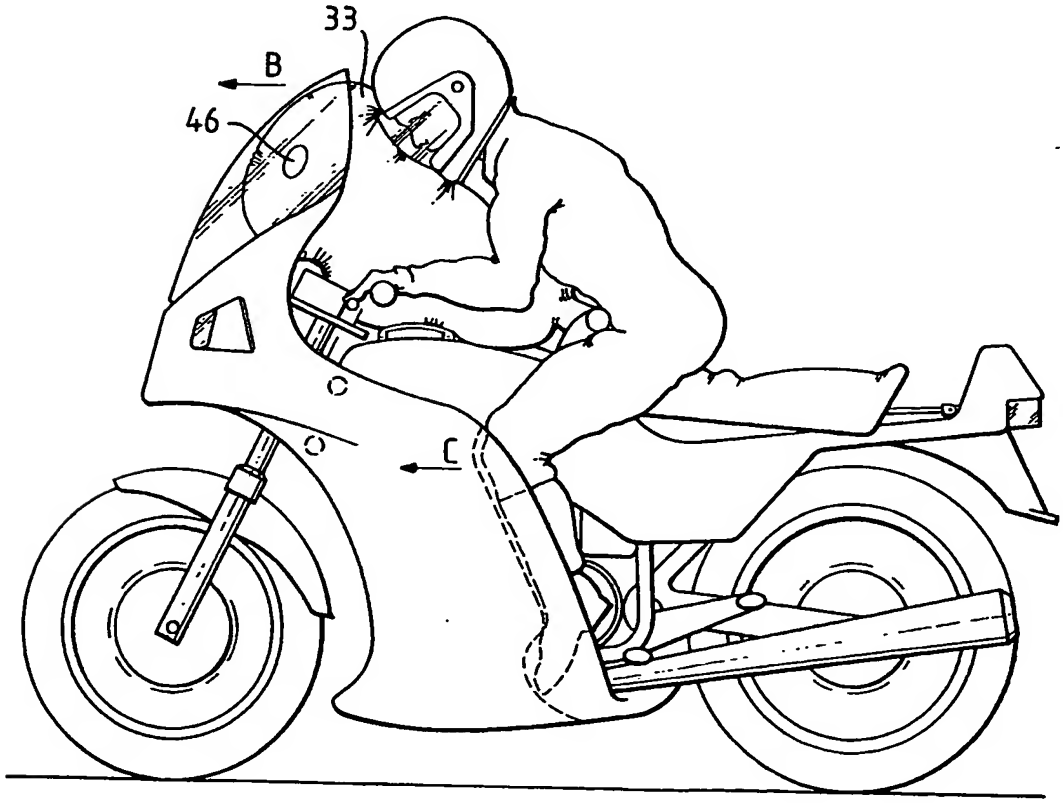
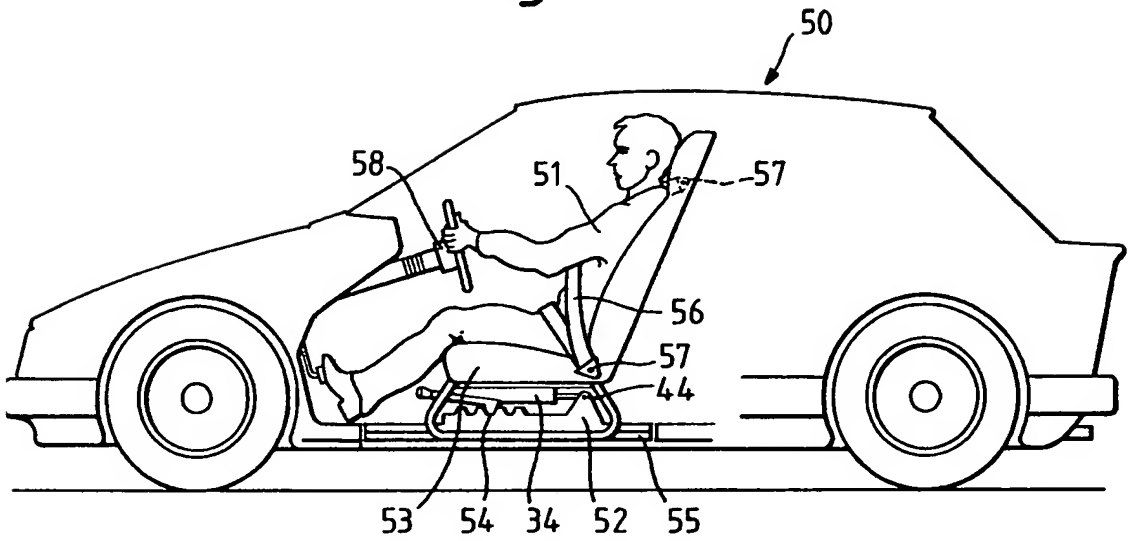


Fig.5.



SPECIFICATION
Vehicle safety system

The invention concerns improvements in or relating to vehicle safety systems and particularly, but not exclusively to safety systems for bodies transported by the vehicle in the event of the vehicle being involved in a collision.

A particular example of a known vehicle safety system is that of a deformable chest pad restrainer on a motorcycle for protecting the driver. When involved in a frontal impact, the motorcyclist is in danger of leaving the vehicle with a forward velocity approaching that of the machine immediately prior to impact. The chest pad restrainer alleviates the risk of injury due to collision by absorbing some of the kinetic energy of the driver as he travels forwards. The pad is mounted on the motorcycle via a deformable support and abuts the chest of the driver in normal travel. When subjected to a forward force it deforms in a controlled manner thereby absorbing energy.

A disadvantage of the chest pad is that it absorbs energy over an unsuitable part of the drivers body. Additionally it is relatively obtrusive in normal travel.

Another example of a known vehicle safety system is the proposal to use automatically inflating cushions in a car to provide a screen between the passengers and the windscreen in the event of collision. It has been proposed to initiate inflation of the cushions by an electrical signal from an accelerometer mounted in the car so that the cushion inflates when the car suffers deceleration greater than a predetermined level. This system however has shown itself to be unreliable since spurious signals from the accelerometer can cause inflation when not required.

An aim of the invention is the provision of a vehicle safety system for a body transported by the vehicle wherein the system provides increased reliability and is unobtrusive.

According to the present invention there is provided for a body transported by a vehicle a vehicle safety system including

a platform for supporting the body,

securing means for securing the body to the platform,

a guide along which the platform is movable, and

energy absorbing means associated with the platform such that, when subjected to a force along the guide, the platform moves along the guide and the energy absorbing means absorbs energy imparted to the platform by the force.

The platform may be connected to the guide so that the platform is movable with respect to the guide when a force greater than a first predetermined threshold force is applied to the platform.

The vehicle safety system may additionally include at least one inflatable cushion arranged to inflate under the influence of a switch which switches as a result of movement of the platform with respect to the guide.

Preferably, the vehicle safety system includes an inflatable cushion which is inflatable at a position forward of the platform as measured with reference to its direction of movability.

The cushion may additionally include an outlet valve to allow controlled egress of gas from the cushion.

The vehicle safety system may be for the protection of a motorcyclist in which instance the platform may constitute a seat mounted on a guide over the upper frame of the motorcycle. The securing means may then comprise a pelvic restraint consisting of a 'T'-shaped stop formed in the front of the seat so that the motorcyclist may then sit astride the upright of the 'T' with the horizontal arms of the 'T' abutting his pelvis. The guide in the case of the motorcycle safety system may then be a rail allowing the seat to move towards the handlebars over the top of the petrol tank. The inflatable cushion may then be incorporated in the front of the seat.

The energy absorbing means may consist of deformable members associated with the platform which deform when subjected to a force greater than the first predetermined threshold force.

The vehicle safety system for the motorcyclist may additionally include knee restraints comprising energy-absorbing knee stops. The knee restraints may be mounted at both sides of the motorcycle forward of the seat and may be associated with leg protectors. The knee restraints may be arranged to absorb kinetic energy from the motorcyclist in the event that his seat moves forwards sufficiently for his knees to impinge on the knee restraints.

The vehicle safety system for the motorcyclist may also include a restraining wind-shield to provide restraint for the upper part of the motorcyclist's body. The windshield may be arranged to remain fixed in an upright position until subjected to a force greater than a second predetermined threshold force in a direction towards the front wheel. The windshield may then be arranged to deform, thereby absorbing energy when subjected to a force greater than the second predetermined threshold force.

The vehicle safety system may be for an occupant of a three or more wheeled vehicle, in which instance the platform may consist of a vehicle seat. The securing means may then comprise a seat belt which secured the occupant to the seat without depending on anchorages to the vehicle body. The guide may then constitute a set of rails allowing the seat to move along the floor of the vehicle. The inflatable cushion may then be arranged to inflate in front of the occupant of the seat so as to cushion him from collision with either the seat in front or the windscreen.

The vehicle safety system may be for freight carried by a transporter, especially freight of a sensitive nature, for example explosives or toxic fluids. The freight containers may then be secured by the securing means to a platform which is

mounted on a set of rails on the transporter which serve as a guide. Inflatable cushions may then be provided in association with the freight containers to protect the freight in the event of collision.

The invention will now be described by way of example only, with reference to the accompanying drawings consisting of

Fig. 1 showing a generalised motorcycle incorporating a vehicle safety system according to one aspect of the invention,

Fig. 2 showing schematically in side elevation a motorcyclist seated in the motorcycle of Fig. 1,

Fig. 3 showing in side elevation an energy absorber incorporated in the seat of the motorcycle of Figs. 1 and 2,

Fig. 4 showing a view equivalent to Fig. 2 during actuation of the vehicle safety system.

Fig. 5 showing schematically a cutaway side elevation of a generalised motor car incorporating a vehicle safety system according to another aspect of the invention.

In Fig. 1 a motorcycle 10, has a seat, 12, having an integrally formed pelvic restraint, 14, at the front of the seat. The pelvic restraint, 14, is formed as a 'T'-shaped stop so that a driver of the motorcycle sits astride the upright of the 'T' with the horizontal arms of the 'T' abutting his pelvis. This is shown schematically in Fig. 2.

The seat, 12, is mounted on a pair of rails, 16, on the upper frame of the motorcycle. The rails continue over the top of a petrol tank, 18. (The section of the rails beneath the seat, 12, is not visible in Fig. 1.)

Also incorporated in the structure of the seat, 12, and not visible in Fig. 1 are energy absorbers of the type made by Imperial Metal Industries. One such energy absorber is illustrated in Fig. 3.

In Fig. 3 an energy absorber, 34, consists of a plastic rod, 36, with a hole, 38, bored along the centre and a metal plunger, 40, having a first end, 44, and a conical end piece, 42, at the opposite end. The end of the plunger carrying the conical end piece is situated inside the plastic rod whilst the other end, 44, extends to the exterior of the rod.

The plunger may be pulled out of the plastic rod by pulling the end, 44, in the direction shown by arrow A in Fig. 3. The energy absorber is designed so that the plunger will move only when a force greater than a predetermined force, F_o, is applied to end 44. Due to the presence of conical piece 42, as plunger 40 moves along rod 36, energy is dissipated by the pulling force in deformation of the plastic. The extent of the dissipation is determined by the bore of hole 38 and the size of the base of conical end piece 42.

When incorporated in the seat, 12, the end, 44, of energy absorber 34 is fixed to the frame of the motorcycle and the plastic rod, 36, is fixed to the seat.

Another feature of the vehicle safety system of Fig. 1 is a container, 32, mounted at the front of the seat, 12. (A small part only of the container is visible in Fig. 1.)

The container, 32, contains an inflatable cushion (not visible in Fig. 1) and a cylinder (also not visible in Fig. 1) containing sodium azide and is of the type made by Talley Industries of Arizona Incorporated. The cyclinder is connected to the motorcycle battery by a switch (not indicated in Fig. 1).

A further feature of the vehicle safety system of Fig. 1 is a pair of knee restraints, 20, incorporated in a pair of leg protectors, 22, which are fixed to the framework of the motorcycle. A knee restraint on one side of the motorcycle may be seen better in Fig. 2. The knee restraint of Fig. 2 consists of a block of crushable foam, 26, mounted on the associated leg protector, 22.

A still further feature of the vehicle safety system is a windshield, 28, mounted at the front of the motorcycle by windshield fixings, 30.

In use the vehicle safety system operates to minimise injury to the driver when he is involved in a head-on collision. The vehicle safety system does this by gradually absorbing kinetic energy from the body of the driver, the energy being associated with the forward motion which he retains after the motorcycle has been brought either to an abrupt halt or to a much reduced speed. By absorbing this kinetic energy the risk of the driver being thrown forwards from the motorcycle is reduced.

The vehicle safety system of Fig. 1 achieves its objectives by firstly restraining the pelvis of the driver via the pelvic restraint, 14. When the driver is involved in a head-on collision he tends to retain his forward velocity, exerting a forward push on the pelvic restraint, 14. If this push is greater than a predetermined force, F_1, the seat, 12, is made to move along the rails, 16, and ride up the petrol tank, 18, towards the handlebars of the motorcycle. In doing so, kinetic energy is converted to deformation energy of the energy absorbers, 34, in the seat. The seat additionally acts as a contact such that, when the seat moves, the switch between the cylinder and the motorcycle battery is closed and the battery becomes connected across the cylinder. The applied voltage has the effect of initiating a chemical reaction in the sodium azide contained in the cylinder, the result being instant evolution of nitrogen gas which inflates the cushion, 33, as shown in Fig. 4. The inflation of the cushion between the driver and the windshield allows the cushion to absorb the kinetic energy of the upper part of the motorcyclists body and so to arrest the rotation of the upper part of the motorcyclists body about the pelvic restraint. Energy absorption is aided by a valve, 46, in the cushion which allows controlled egress of gas from the cushion when it is subjected to pressure from the driver's body.

In addition to absorption of energy by the cushion, 33, the windshield, 28, is arranged to also absorb energy. In order to do so the windshield fixings, 30, are adapted to hold the windshield in an upright position when a fowards push less than a predetermined threshold force, F_2, is applied to the windshield. When the force

exceeds F_2 the fixings, 30, fail in a controlled manner and allow the windshield to deform by bending forwards as shown by arrow B in Fig. 4.

A third energy absorption process takes place in the knee restraints, 20. As the seat, 12, moves forwards along the rails, 16, the driver's knees impinge against the knee restraints 20, on either side of the motorcycle. On doing so the foam from which they are constituted crushes as shown by arrow C in Fig. 4, thereby absorbing kinetic energy from the leg region of the driver's body.

In Fig. 5 an alternative embodiment of the invention is shown in a motor car 50. The vehicle safety system for the driver 51 of the motor car comprises the energy absorber 34 shown in Fig. 3 attached by the first end 44 to the structure of the motor car through a suitable fixing 52. The plastic rod, 36, is attached to the drivers seat 53 via a seat positioning mechanism 54 provided to allow adjustment of the seat position on rails 55 to one suitable for the size of the driver. A lap and diagonal seat belt 56 with anchorage points 57 on the seat connects the driver to the seat and transmits the forward motion of the driver to the seat and hence to the energy absorber in the event of a collision. An air bag is provided in the steering wheel hub 58, or an appropriate part of the dashboard or the back of the front seats for occupants of the motor car other than the driver.

When the force transmitted to the energy absorber exceeds a threshold force, F_3, the seat and occupant move forwards dissipating energy by deformation of the energy absorber. As a result of the forward movement, the seat closes a switch (not shown) which initiates the inflation of the airbag.

In a still further aspect of the invention the vehicle safety system may be applied to a freight transporter, the freight being supported on a platform incorporating energy absorbers and mounted on rails. In the event of a collision the platform is movable along the rails so as to initiate inflation of a protective cushion to minimise damage to the freight.

An advantage of the general inventive vehicle safety system is that the inflation of the cushion is initiated by a mechanical process i.e. the closing of the circuit switch by the seat or the platform. A mechanical process avoids the problems of false initiation by spurious electrical signals as in prior art systems which rely on an electrical signal from an accelerometer.

A further advantage of the general inventive vehicle safety system is that it can readily be incorporated into previous vehicle designs. In a simple form the invention involves merely an adaptation of the seat or platform to provide movement and addition of an inflatable cushion as protection. Additionally, the vehicle safety system is unobtrusive to drivers or passengers of vehicles in normal travel.

The invention is not confined to the details above. In the vehicle safety system as applied to the motorcycle, for example, the separate safety features of, firstly the inflatable cushion, secondly the knee restraints and, thirdly, the deformable windshield may be either all omitted or included in any combination. If all are omitted the vehicle safety system becomes merely a movable, energy-absorbing moving seat system.

Similarly, the system applied to the motor car may omit the air bag.

The energy absorbers, 34, of Fig. 3 may be replaced by alternative energy absorbers such as, for example, springs operating beyond their elastic limit.

CLAIMS

1. A safety system for a body transported by a vehicle including:

a platform for supporting the body,

securing means for securing the body to the platform,

a guide along which the platform is movable, and

energy absorbing means associated with the platform such that, when subjected to a force along the guide, the platform moves along the guide and the energy absorbing means absorbs energy imparted to the platform by the force.

2. A safety system as claimed in claim 1 wherein the platform is movable along the guide when a force greater than a predetermined threshold force acts on the platform.

3. A safety system as claimed in claim 1 or claim 2 wherein at least one inflatable cushion is arranged to inflate under the influence of a switch, the switch being closed as a result of movement of the platform along the guide.

4. A safety system as claimed in claim 1 or claim 2 or claim 3 wherein the platform is the seat of a motorcycle, the rider of said motorcycle being secured to said seat by means of a pelvic restraint.

5. A safety system as claimed in claim 1 or claim 2 or claim 3 wherein the vehicle has three or more wheels, the platform being a vehicle seat, the securing means being a seat belt securing the body to said vehicle seat, the energy absorbing means connected between the seat and the vehicle body, being arranged to absorb the energy of the forward motion of the seat relative to the vehicle body.

6. A vehicle safety system substantially as hereinbefore described with reference to Figures 1, 2, 3 and 4.

7. A vehicle safety system substantially as hereinbefore described with reference to Figure 5.

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